



THE
LABRADOR PENINSULA

(WITH A MAP)

BY

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Geological Survey of Canada.

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By ROBERT BELL, B.A., Sc., M.D., LL.D., of the Geological Survey
of Canada.

(*With a Map and Illustrations.*)

Boundaries.--The Labrador peninsula forms the large eastern division of the mainland of North America. In latitude, its centre is midway between the Gulf of Mexico and the northern extremity of the continent at Bellet Strait. It lies between Hudson Bay on the west and the North Atlantic Ocean on the east, with Hudson Strait on its northern side. The dividing line between this great peninsula and the rest of the continent has not yet been authoritatively defined, but it may be assumed to extend from the mouth of Rupert river at the southern extremity of Hudson Bay to Lake St. John at the head of the Saguenay river and fiord, the distance across this neck of land being about 350 statute miles.

Dimensions.--As thus defined, the southern point of the peninsula at Tadousac on the St. Lawrence is in latitude $48^{\circ} 10'$ and the northern extremity, Cape Wolstenholme, on Hudson Strait, in latitude $62^{\circ} 35'$. From this cape the shore runs nearly east for 150 miles. The length of the peninsula from north to south is therefore about 1010 English statute miles. A line drawn from Tadousac to Cape Wolstenholme would run nearly north-north-west, and measure about 1070 statute miles. The eastern coast from Belle Isle, in latitude 52° , up to latitude $53^{\circ} 30'$, runs due north, on the meridian of $55^{\circ} 40'$. On the opposite, or Hudson Bay, side of the peninsula, the sea-coast in the same latitudes also runs due north, and corresponds with the meridian of 79° . In latitude 53° the peninsula will therefore have a breadth of 1015 English statute miles. Cape Jones, where James Bay opens out into Hudson Bay proper, is in longitude 80° and is the most westerly point of the peninsula. A line drawn from the Strait of Belle Isle to Cape Jones would measure 1065 statute miles, so that Labrador is practically as broad as it is long.

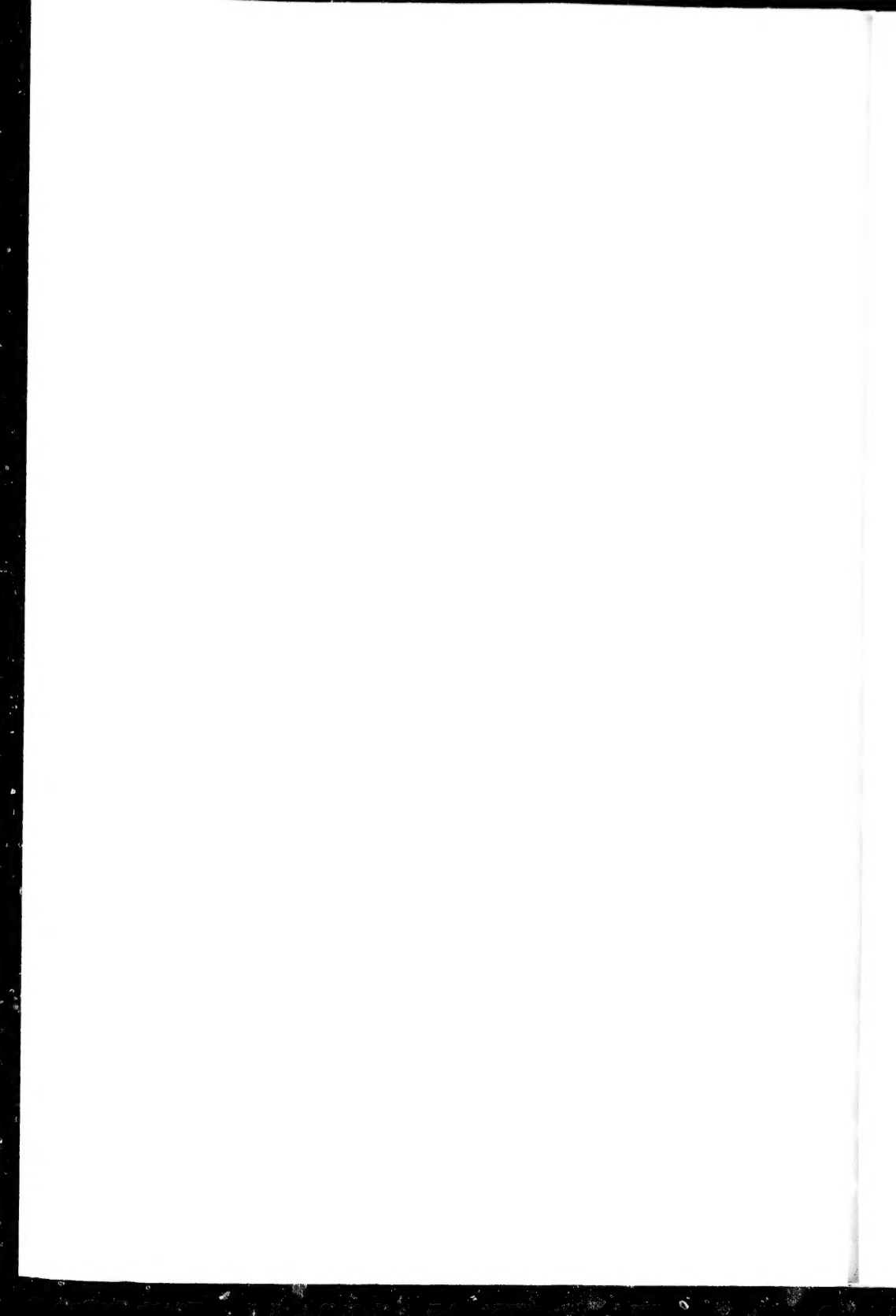
Area.--The superficial extent of the Labrador peninsula has been roughly estimated at 420,000 square miles. Unless geographical miles

are intended to be understood in this estimate, it is far too low, for I find on making a careful computation of the area of its surface, following the figure of the earth independently of any map-projection, that its total extent within the boundaries above defined, and including the lakes, is very close upon 560,000 square English statute miles. In making this computation, I used the areas of quadrilaterals of the earth's surface for each degree of longitude in each degree of latitude. This is 4000 square miles greater than the areas of Great Britain and Ireland, France, Germany, Belgium, and Holland combined. The nearest point of this great region, so little known to the British public, is less than 2000 statute miles from the western shore of Ireland, Belle Isle being only 1750 geographical miles from Malin Head in the northern point of that island. The whole peninsula is, of course, under the sovereignty of Great Britain. Newfoundland claims about 140,000 square miles, the remaining 420,000 belonging to Canada. In the following pages, when the name Labrador is used, it is to be understood as designating the whole peninsula. Throughout the maritime provinces this region is called *The Labrador*.

SOURCES OF INFORMATION.—Although many books and papers have been written about various parts of the Labrador peninsula, and numerous maps have been published showing portions of its coast-line, the writer is not aware of any general map and description of the whole region, giving the results of all the explorations and investigations which have been made up to the present year. The following general account of the country and the accompanying map are intended to supply this want, as far as possible. It may be as well, however, for me in the first place to mention the opportunities I have had of obtaining the necessary materials to enable me to write upon this subject. In 1875-77 I explored and partly surveyed the western side of the peninsula, or East Main coast of Hudson Bay, from its southern extremity nearly to Mosquito Bay. In 1880 I passed through Hudson Strait in the *Ocean Nymph*, belonging to the Hudson Bay Company, and on that occasion had close views of many places along both shores. I was naturalist and medical officer to the expedition sent out to Hudson Strait and Bay by the Government of Canada in 1884-85 in the steamships *Neptune* and *Alert*, and had opportunities of visiting the southern or Labrador side of the Strait and of exploring the east coast of Hudson Bay from Cape Wolstenholme southward towards Mosquito Bay, thus leaving only a limited gap between the part then examined and that which had been explored in 1877. It should be here mentioned, that in the course of these different explorations of the East Main coast, I made limited excursions inland in numerous places, either on foot or by the rivers, which were sufficient to give me a good idea of the character of the country away from the coast. Since 1877, Mr. A. P. Low of the Geological Survey has made surveys of East Main river and parts of Big river, Little and Great Whale rivers, and Clearwater river. While going out or returning by the *Neptune* in 1884, and the *Alert* in 1885, a near view of almost the whole of the eastern Labrador coast was obtained, and we also landed at a few points. In 1858 I assisted in an exploration

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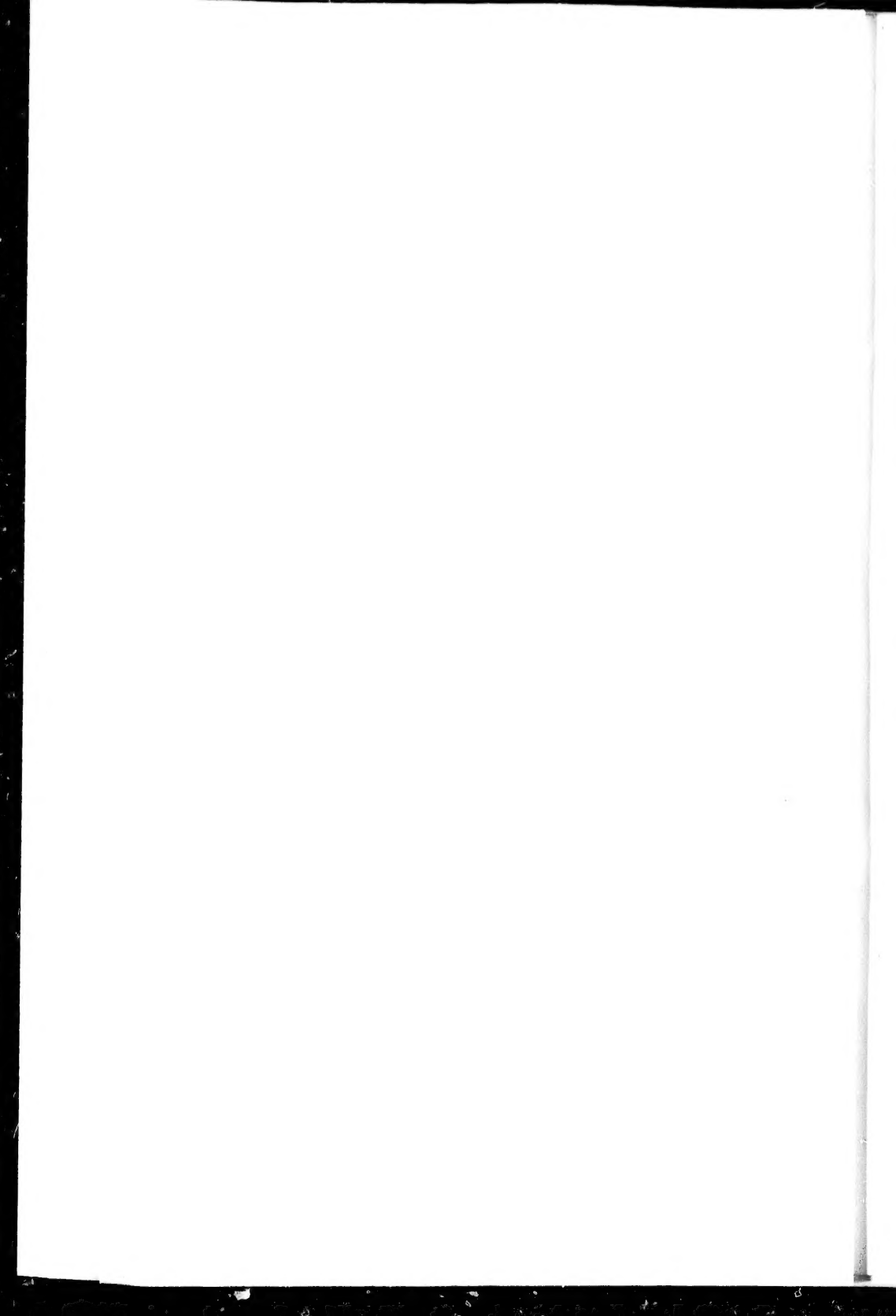
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DR. FELL AND PARTY, WITH GROUP OF ESKIMO, AT POWNGA
(About 20 miles S. of Cape Wostenholme).

From Photograph by Dr. Fell.



of Lake St. John and the Saguenay, and in 1868 I coasted in a small schooner all the way from the Saguenay to the Strait of Belle Isle and ascended some of the rivers for short distances.

Having seen so much of Labrador myself, I have been the better able to obtain and to appreciate the large amount of valuable information in regard to it which I have derived from personal intercourse with a number of people who have a knowledge of various parts of the region. These include traders, explorers, missionaries, fishermen, &c. Among them I may mention Mr. John McLean, author of *Twenty Years' Service in the Hudson Bay Territories*, who traversed Labrador several times, and whom I met frequently at Elora in Ontario, whither he had retired; the late Captain William Kennedy, the Arctic explorer, who was agent for the Hudson Bay Company at Fort Chimo and George River Fort in Ungava Bay, and at old Fort Naskopie in the eastern interior; Sir D. A. Smith, who resided many years on the eastern coast; Messrs. Robert Crawford, Peter McKenzie, and Keith McKenzie, who have successively had charge of Fort Chimo; Mr. Lucien Turner, who was agent at Ungava for the Smithsonian Institution from 1882 to 1884; the six gentlemen who had charge from 1881 to 1886 of the three government meteorological stations at Cape Chidley, Prince of Wales Sound, and Cape Wolstenholme, especially Mr. R. F. Stupart, now Director of the Meteorological Service of Canada, and Mr. F. F. Payne of the same service; also Mr. William Skynner, of the Observatory at Nachvak, on the east coast, south of Cape Chidley; Rev. E. J. Peck of the Church Missionary Society, who crossed the northern part of the peninsula from Richmond Gulf to Ungava Bay, and kindly furnished me with a copy of his itinerary and map; Mr. J. G. A. Creighton of Ottawa, who made an exploration for the Geological Survey between the Gulf of St. Lawrence and the head of Hamilton Inlet; also several of the officers of the Hudson Bay Company, lately resident on the eastern coast, and some of the Moravian missionaries whom we visited on that coast in 1884.¹

Low and Eaton's Explorations.—But I am more particularly indebted to Mr. A. P. Low of the Geological Survey, and his assistant, Mr. D. I. V. Eaton, for scientific information as to the interior. In 1893 these gentlemen made a traverse through the central portion of the whole peninsula from Lake St. John, by way of Lakes Mistassini and Nitehiquan, and the Kaniapiskow lake and river to Ungava Bay. On their arrival at Fort Chimo they fortunately caught the Hudson Bay Company's annual steamer, *Erie*, bound for Rigolet on Hamilton Inlet, and they spent most of the winter at the North-West river post of the Company, near the head of the inlet. During the spring and summer of 1894 they

¹ The following positions were determined in 1890 by Mr. William Ogilvie, Dominion Topographical Surveyor, who received the Royal Geographical Society's medal for his exploration of the Yukon river (*S.G. M.*, vol. vii. p. 211):—Rupert's House, lat. 51° 29' 27", long. 78° 45' 00"; East Main Post, lat. 52° 14' 44-91", long. 78° 29' 15", or 5 h. 13 m. 57 s.; (Residence) Moose Fy., lat. 51° 14' 43", long. 80, 35' 00". The position of the Hudson Bay Company's post on East Main river was ascertained with the closest accuracy, while the other determinations are very good, and certainly the best existing.

surveyed the Hamilton river to Lake Petitsikapow, where the upward course of the river turns from a north-westerly to a southerly direction. They then surveyed Michikamow lake and a route thence southward by Atikonak and Ossokmanowan lakes and the Romaine river to the Mingan Islands on the north shore of the Gulf of St. Lawrence. Messrs. Low and Eaton's explorations for 1893 involved perhaps the most arduous journey hitherto undertaken by officers of the Geological Survey, and their work of 1894 also proved difficult in contending with snow and slush in spring, and afterwards on account of the great number and the rough character of the portages which the explorers were obliged to cross. Both the above journeys were performed with small canoes, which in the spring of 1891 were hauled over the snow before the opening of navigation. Game was scarce, and fish caught in gill-nets each night constituted their principal food. These gentlemen deserve much credit for their perseverance in successfully carrying out the above work in Labrador. Believing that their names should be recorded in the region of their explorations, I have placed them on the two lakes lying to the north-west of Lake Michikamow, as shown on the accompanying map.

The Eastern Coast.—The best-known portion of the peninsula is the eastern coast, which in the popular mind is generally associated with the name Labrador. A good summary of our knowledge of this region is given in Dr. A. S. Packard's *The Labrador Coast*, published in New York in 1891, and I have had some correspondence with the author on matters discussed in his book. I have also had access to the older books and maps which have been published on the subject of Labrador. From all the foregoing sources of information, which include the most recent, it is proposed to give in the following pages a succinct general account of the Labrador peninsula which shall convey as much definite and substantial information as may be possible in the space devoted to it.

GENERAL DESCRIPTION.—The Labrador peninsula may be described in a general way as a moderately-elevated plateau of Archaean rocks, hilly, interspersed with many lakes, and having a surface partly of swamp and bare rock, and partly overspread with boulders and coarse glacial *débris*, rendering the greater portion of it unfit for cultivation. Its sea-borders are rather abrupt all round, except in a few sections, where the country is low for some distance inland. In three parts of its coast-line, ranges of mountains or great cliffs and hills of rock rise directly from the sea. The first and highest of these follows the whole Atlantic border, which has a length of 760 statute miles. The next is a range of mountains and precipices from 500 to 2000 feet in height overlooking Hudson Strait, and running along the whole of the most northern coast, which stretches from Cape Hope's Advance to Cape Wolstenholme, a distance of 270 statute miles. The third mountainous section is that part of the western coast which lies between Cape Jones and Cape Dufferin and has a length of 350 miles. Here the hills or mountains rise to heights of 1000 to 2000 feet, within a short distance of the sea nearly all along. The southern shore from the Saguenay to the Strait of Belle Isle cannot be

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The shores of Ungava Bay are low all around, with the exception of some small hills of rock about the mouth of the Koksoak river. A low tract of country extends westward from this bay across the peninsula to Mosquito Bay; and the western coast is mostly quite low from the latter bay southward to Cape Dufferin. All the way from Cape Jones to Rupert Bay the shore is less rocky than elsewhere on the East Main coast, and as a general rule it rises gradually from the sea. A large tract, shown on the accompanying map, extending inland from the east side of James Bay, appears to be less than 600 feet above the sea, except, perhaps, in a few places. Most of the country between Rupert Bay and the Saguenay, forming the neck of the peninsula of Labrador, is hilly, with an elevation in the central part of about 1500 feet.

General Elevation of the Peninsula and of the Interior Plateau.—The general elevation of the interior plateau is probably not far from 1800 feet above the ocean. Professor H. Y. Hind states it at 2240 feet, which is probably too great. Mr. Low estimates the mean elevation to be 1500 feet, which may be more nearly correct as an average for the whole peninsula, allowing for the diminution which would be caused by taking into consideration the low level of the tract around Ungava Bay and of the greater part of the northern division, as well as the moderate elevation of the district on the east side of James Bay. But these low areas may be fully compensated for by the excess in the elevation of the north-east coast range and the high ground inland from the mountainous part of the East Main coast, so that, taking together the low tracts on the one hand and the mountainous portions on the other, their mean elevation may not be far from that of the general plateau.

The mean of the estimates of Hind and Low is 1870 feet. Mr. Low gives the height of Lake Mistassini as about 1350 feet above the sea, but the surrounding country is considerably higher. He ascertained by the aneroid barometer that Lake Nitchiquan, at the source of Big river, has an elevation of about 1800 feet and Lake Kaniapiskow of about 1700 feet. These two lakes are in the centre of the peninsula, but not far to the south-west of the former the hills rise to a height of 500 feet, and to the north-east of the latter to 700 feet, above the canoe route. Lake Michikamow, a short distance north-east of Grand Falls on the Hamilton river, cannot be far from 1500 feet above the sea, and Mr. Low says "it is surrounded by barren rocky hills from 200 to 700 feet in height." Bryant, by means of a standard compensated aneroid, found that the highest point in the neighbourhood of Grand Falls was only a little more than 1500 feet above the sea, but the general elevation of the country increases considerably to the north-westward. If we add 200 feet for this increase and the same for the general altitude of the country above the surfaces of the four lakes just mentioned, we shall find the average to be 1770 feet. The tops of the higher hills within sight of the coast between Cape Jones and Dufferin are about 2000 feet high, and the general elevation probably increases to the north-eastward

as far as the height of land, about midway to Ungava Bay. Caley gives the elevation of a hill near the upper part of the Moisie river, in the southern portion of Labrador, as 2214 feet above the sea. From the foregoing considerations, and until a greater number of facts are available on which to base more exact calculations, we may assume that the average elevation of the Labrador plateau, if not of the whole peninsula, is about 1800 feet above the sea.

Archaean rocks similar to those of Labrador continue to the south and west of Hudson Bay, but with a diminishing elevation and a less sterile surface, and, in connection with the subject of these general levels, it may be mentioned that on the canoe routes between the Bay and Lakes Huron and Superior, the watershed has an altitude of about 1000 feet above the sea in nearly all cases, and the general elevation of the height of land in this region is 200 or 300 feet higher.

Mountains.—The chain of mountains along the eastern side of Labrador is scattered and ill-defined from the Strait of Belle Isle to Hamilton Inlet, but northward of this great fiord it becomes more regular. At first it is broad and low, but becomes narrower and higher as we proceed up the coast, till it has attained its maximum elevation in the interval between Saglek Bay, 140 statute miles south of Cape Chidley, and the Four Peaks, 70 miles south of the same cape. From this highest part the general elevation diminishes northward to Cape Chidley, where it is about 1500 feet. The peaks just mentioned are represented on the Admiralty charts as having elevations of 6000 feet, and numerous other points in the 70 miles to the south of them appear to be at least equally high. In Dr. S. Weiz's map of the north point of Labrador (1868), a ridge to the west of the Four Peaks is represented as 8000 feet high. Dr. R. Koch, who spent the winter of 1882-83 at Nain, says: "The highest points of this range are opposite the island of Aulatsivik (Aulezavik or Aulalsivik), and reach elevations of from 8000 to 9000 feet." This range is the highest ground in British America east of the Rocky mountains.

The mountains forming the northern part of the chain have not been glaciated like the rest of Labrador, and they present steep sides with jagged crests rising out of the cold sea. Patches of snow remain in sheltered places throughout the year. Here in summer there is great richness and variety in the colouring and atmospheric effects, so that the scenery is beautiful, as well as grand. Indeed it can hardly be excelled in any part of the world.

In the interior there are no distinct mountain ranges, and the heights of land between the different drainage areas are not marked by sharp elevations, but, as in other Archaean regions in Canada, they generally constitute the most level belts. The hills are mostly unconnected, irregular, and of endless variety of profile and basal form. In other parts of the great Archaean area of Canada, the glaciation has been more intense, and the resulting surface may be said to be mammalated, but this description does not apply so well to Labrador.

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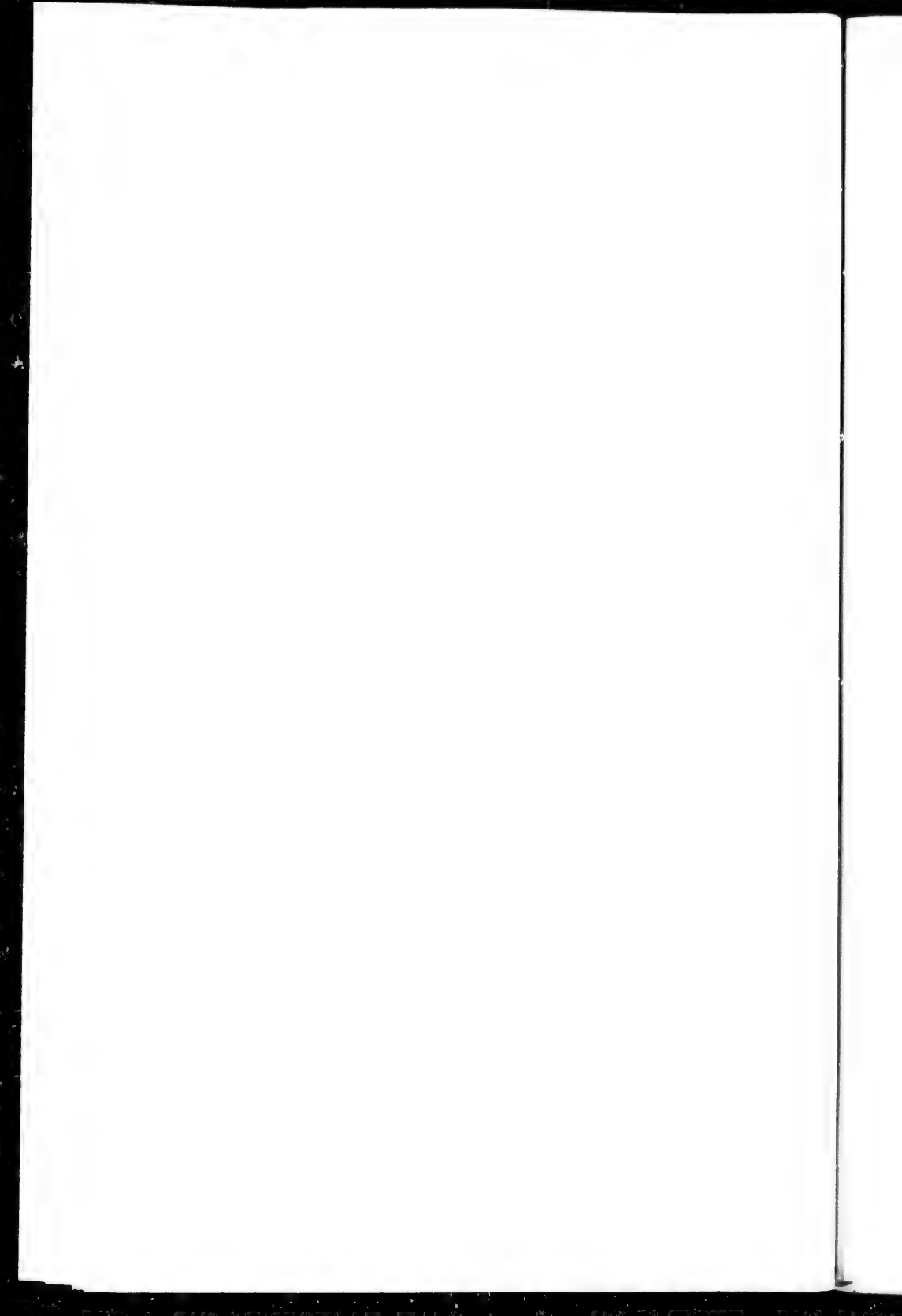
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they are in the glaciated Archæan regions of Canada in general. There is, however, an absence of any very large bodies of fresh water, such as are to be found on the opposite side of Hudson Bay. A few of the largest are about 100 miles long, while a dozen others measure something like half that length, and lakes of 20 or 30 miles are quite numerous. Lake Mistassini, in the southern part, has been surveyed and found to measure almost exactly 100 miles, along its gentle curve, by a width of 15 miles in the middle; but as it narrows regularly towards each end, it may not have as great an area as some of the shorter but wider lakes of the peninsula. Lake Mistassini, parallel to its south-east side and close to it, is about 66 miles long, but it has no great width. Payne lake (so named by the late Captain A. R. Gordon, R.N., after the observer F. F. Payne, who first ascertained its position, etc.) is situated in the opposite or northern part, and is reported to be about 20 miles long by 25 wide. If this be the case, its area is probably greater than that of any other lake in Labrador. Big Seal lake is said to be about 90 miles long and 20 wide, which would make it second in point of area, judging from the outlines of these two lakes as represented on the sketch-maps, as well as from their assumed lengths and breadths. Michikamow lake, the largest in Eastern Labrador, was surveyed by Messrs. Low and Eaton, and found to measure 55 miles from north-west to south-east, independently of some long bays which may give it a total length of 75 miles. Its greatest width exceeds 20 miles, and Mr. Low thinks its area may surpass that of Lake Mistassini.

Two principal lake regions occur in Labrador, the eastern being situated around the headwaters of the Michikamow or Grand Lake river, the Hamilton and the George rivers; while the western one lies inland from the great recess of the East Main coast. The eastern group embraces the following lakes: Michikamow (the Great or Grand lake), Low, Eaton, Waquash, Nattecamabagan, Petitsikapow, Naskopie, Flour, Sandy, Ossokmanowan, Ashwanipi, and Atikonak.

The lakes of the western group discharge their waters principally by the Nastapoka, Clearwater, and Little Whale rivers. Clear (or Clearwater) lake is the most accessible of the group. Mr. Low surveyed a canoe route from Richmond Gulf to the outlet of this lake and found the distance to be 50 miles in a straight line, but he did not explore the lake itself. The four large lakes in this region, as represented on the accompanying map, are taken from sketches, with notes, made for me by two intelligent Indian hunters named Crow and Shem Williams. From their descriptions, Clear lake would appear to have a length of about 90 miles, Big Seal lake of about 100, Little Seal lake of about 75, and Apishagami of about 50 miles. Apishagamish (Little Apishagami) discharges by both Great Whale and Big rivers, while Big Seal lake seems to discharge into Clear lake as well as by the Nastapoka river. Kenogamissie (Little Long lake) and Height-of-Land lake, both said to be large sheets of water, also belong to this group. On the sketch-map of this region, obtained by Rev. E. J. Peck from his Indian guides, Northern Seal lake is represented as a wide stretch of

water, which would have a length of about 35 miles. Its centre would be about in latitude $57^{\circ} 20'$ and longitude $75^{\circ} 30'$. It probably discharges by a river the mouth of which I located in 1877 ten miles north of the Nastapoka.

Clear lake is remarkable for the great transparency of its waters, and, like all the other lakes of the region, it abounds in fine fish. These attract numerous seals, which ascend by way of the Nastapoka river. Mr. Low says the Indians told him that Big Seal lake is much larger than Clear lake, and that it is surrounded by a low, flat country, totally barren. Mr. Peck mentions the same thing in his journal. It may be inferred, partly from this information, and partly from the shape of the northern part of the lake itself, that Silurian rocks possibly occur around it. Another circumstance which favours this supposition is the fact that on a hill of Laurentian gneiss (like that of the surrounding country), 200 feet in height, near the outlet of Clear lake, Mr. Low found a boulder of light-coloured limestone containing corals of Upper Silurian or Devonian age. The direction of the drift was from Big Seal lake towards this point.

Among the remaining lakes of Labrador which deserve mention are Erlandson's lake, so called by Mr. John McLean after a German of that name in the employ of the Hudson Bay Company, who, in 1834, was the first white man to cross the country from Ungava Bay to Hamilton Inlet, then called Eskimo Bay. Mr. McLean, from having walked several times over its whole length upon the ice, estimated it to be fully 40 miles long, with an average breadth of two miles and a half. Mr. Low gives the length of Lake Nitchiquan (Knee lake) at about 30 miles and of Kaniapiskow at about 40 miles, with a narrow part about the middle.

Mr. Peter McKenzie of the Hudson Bay Company, formerly resident at Fort Chimo, informed me that at about 15 miles north west of the mouth of the Ungava river, an opening in the coast leads into a large lake close to the sea, which is affected by the tide and may be entered by schooners. Leaf lake, said to be 70 or 80 miles west of Fort Chimo, is reported to be a large sheet of water, but no authentic information can be obtained in regard to it. Grand and Kenamou lakes, in eastern Labrador, are also considerable sheets of water of which little is known.

Many of the lakes of Labrador, including Michikamov, have two outlets, often to the opposite sides of the watershed, and Clear lake is represented by the Indians as having three discharges, of which one divides into two. Double outlets are of common occurrence in our Laurentian lakes in general, and the frequency of this phenomenon helps to prove the comparative freshness in geological time of the surface of the great Archæan region of northern Canada.

Rivers.—On the Archæan plateaus of Northern Canada generally the rivers do not flow in deep or well-defined valleys, but are prone to spread over the country in straggling channels. I found good examples of this condition on the upper parts of the English, Attawapishkat, Albany, and Nelson rivers. Mr. Low observed a similar character in the upper parts

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ENTRANCE TO RICHMOND GULF IN WINTER.

From Photograph by J. J. Fisher

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of the East Main and on the Hamilton river above Grand Fall. In all these regions the streams must be flowing not far below the general level of the surrounding country. Branches will run off unexpectedly on either side and after a course of 5, 10, or 50 miles will rejoin the main stream. This phenomenon of the Archaean regions of Canada is one of the evidences of the shortness of the period during which the present surface has existed. Denuding agencies have affected it but little, and the rivers have not yet had sufficient time to excavate distinct valleys for themselves.

Four Drainage Areas in Labrador.—The annual precipitation throughout Labrador appears to be as great as in Ontario and Quebec, and consequently the country abounds in streams and rivers. The peninsula has four drainage areas or river systems: (1) a northern, discharging into Ungava Bay and Hudson Strait; (2) a western, into Hudson Bay; (3) a southern, into the River and Gulf of St. Lawrence; and (4) an eastern, into the Atlantic Ocean.

The northern drainage system is the second in point of area, and its greatest river, the Ungava or Kcksoak (Big river), has a length of about 400 miles in a straight line, or upwards of 500 following its general course. Fort Chimo, a trading-post of the Hudson Bay Company, is situated on the east side of this river, about 20 miles from its mouth at the bottom of Ungava Bay; the banks of the river in this interval being high and rocky. The spring-tides rise 40 feet at the mouth of the river, and are felt for about 70 miles up, or as far as The Forks, some 50 miles above Fort Chimo. The western branch is called the Stillwater or Natwakame, and the other the South, and farther up the Kaniapiskow, river. The 70 miles, or thereabouts, of the united rivers below The Forks is all that may be called the Ungava or Koksoak river proper, although the longest branch, or South river, gives the stream a total length of about 400 miles, as above stated. About 120 miles above Fort Chimo a large branch falls into South river on the east side, called Swampy-bay or Waquash river, which is followed as part of the canoe-route to Hamilton river and Michikamow lake. Above this branch South river becomes the Kaniapiskow. A few miles above this tributary the river expands into a lake 25 miles long and from 2 to 5 miles wide, surrounded by rugged mountains. Mr. Low named it Cambrian lake, from the age of the rocks in these mountains. A short distance below, and again not far above, this lake, the river passes between perpendicular walls 1000 feet high, and is here full of rapids and falls. Farther up, in about latitude 56°, it plunges through another gorge, which Mr. Low named Eaton cañon, after his assistant, in which it falls 350 feet in one mile. Above this cañon the country for about 70 miles is hilly, some points rising 500 to 700 feet over the river; but in approaching Kaniapiskow lake it becomes flat, with occasional ridges.

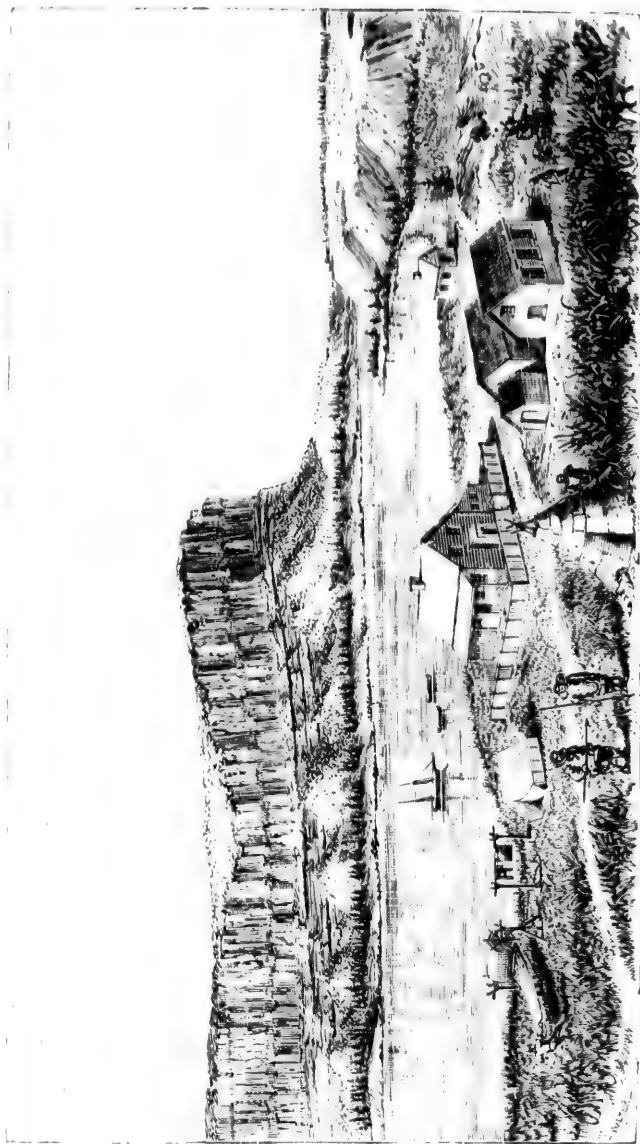
According to Rev. E. J. Peck, the Stillwater or Natwakame branch, which he followed from the height of land near Big Seal lake, is a large river, and easy to descend in canoes. It is greatly increased by the influx of the Kenogamissie, which rises south of Apishagami lake, and flows in from the south about 40 miles above The Forks.

Any descriptions which we have of the other rivers of Ungava Bay are too indefinite to be worth repeating at length. George river is a very large stream, and flows almost due north throughout its whole course, and it rivals the Ungava in length. Whale river, between these two, is also an important stream. The river which discharges Payne lake, and which may be called Payne river, is said to have a considerable breadth and a course of about 50 miles through a flat country. Mr. Stupart, in coasting along Ungava Bay in 1885, noticed a good many Eskimo living at Tuvik, where it enters the sea, a short distance north of the Bay of Hope's Advance. Two rivers enter Prince of Wales Sound, and a third flows into an inlet about ten miles west of Cape Prince of Wales. Mr. Stupart's men found its banks clothed with willow bushes of a larger size than usual in this region.

The second or western drainage area is the most extensive, and has a breadth in the centre of 500 miles, this being the distance in a straight line from the source of Big river to James Bay; while Great Whale river to the north and East Main river to the south of it are almost equally long. If the general courses of these streams were followed, their total lengths would probably prove to be fully 600 miles. Rupert river in the south has a course of 230 miles in a direct line from Lake Mistassini, which it drains. Northward of Great Whale river the height of land constantly approaches nearer to Hudson Bay, and the streams become progressively shorter all the way to Cape Wolstenholme. The principal ones in order, going north, are Little Whale, Clearwater, Nastapoka, Northern Seal (the outlet of the lake of this name), and Langlands. A beautiful perpendicular fall of about 100 feet occurs at the mouth of the Nastapoka, and another of about equal height at the mouth of the Langlands.

Notwithstanding their magnitude, none of the rivers of the east coast of Hudson Bay is of any value for navigation, except by canoes or light boats. Most of them are obstructed by falls close to their mouths, showing that this coast has been elevated above the sea in comparatively recent geological times. On the Great Whale, Big, and East Main rivers, the first falls are a few miles from the sea; but the distance in each case is too short to be worth utilising for navigation. Every river is broken throughout its whole course by falls and rapids at irregular, but generally short, intervals; and these necessitate portages in ascending or descending in canoes.

The third or southern drainage area has a more uniform breadth than any of the others. Counting it as extending from Lake St. John on the west to the Strait of Belle Isle on the coast, we find it to include fully 50 good-sized rivers. The largest of them are the Outarde and the Manicouagan, which enter the St. Lawrence almost together at about 90 miles below the Saguenay. Each of them has a length of upwards of 200 miles in a straight line; but owing to the great bends in their upper branches, the general course of either would measure at least 300 miles. The Betsiamites or Bersimis, about 25 miles nearer the Saguenay, is an almost equally large stream. Like the rivers of the western drainage area, all those of the southern slope descend too rapidly to be



MOUTH OF LITTLE WHALE RIVER, LOOKING EAST.
(North Bird and H. B. Combs's Post.)

From Sketch by Mrs. B. C.

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utilised for navigation by crafts larger than canoes. The greater number of these south-flowing rivers are more or less valuable for their salmon and trout fisheries. Perhaps in no other part of the world is there such a large number of salmon rivers on a single coast-line.

On the eastern side of Labrador the height of land is too near the coast to admit of the formation of large streams, except towards the south, and therefore the only long rivers of the fourth or eastern drainage basin are those in that direction. They are three in number, and all fall into Lake Melville, which forms the upper part, or the continuation, of Hamilton Inlet. Two of them enter this lake directly opposite to one another, at about 20 miles from its head. The one from the north is called North-West river. It divides into two branches above Grand lake, the western being the Michikamow, flowing from the lake of the same name, and the other the Naskopie. The river coming in from the south is the Kenamou, which has two principal branches, of which the western drains Lake Kenamou. But the largest of the three is the Hamilton river, which enters the head of Lake Melville, its valley being a further continuation of that of the Inlet itself. This river has become noted for its splendid fall, to reach which was the principal motive for the exploration of the river by three different parties in recent years. It was also visited by Mr. Low in the course of his geological explorations in 1894.

Although Grand Falls did not attract much attention before these explorations began, their existence has been long known to the officers and men of the Hudson Bay Company. Mr. John McLean, who in 1849 published his *Notes of Twenty-five Years' Service in the Hudson Bay Territories*, visited Grand Falls in 1839, when on a canoe journey southward from Ungava Bay, and gave an excellent description of them in his book. He did not state their height, but after the time of his visit they were popularly supposed to be much higher than they really are; and Captain Kennedy (referred to on a previous page) was accustomed to speak of them as "The Thousand-feet Falls."

The vague accounts which were current of their wondrous grandeur have induced several gentlemen within the last few years to try to reach them. The first of these was Mr. Randle F. Holme, of England, who made the attempt in 1887, but did not succeed. In 1891 two parties from the United States managed to reach the falls. One of them was the Bowdoin College Expedition, which entered the mouth of Hamilton river on the 27th of July; and Messrs. Austin Cary and D. M. Cole of this party arrived at the falls on the 13th of August. The other expedition of 1891 was that of Mr. Henry G. Bryant of Philadelphia and Professor C. A. Kenaston of Washington. They entered the Hamilton river on the 4th of August, and reached Grand Falls on the 2nd of September. Mr. Low arrived at the falls on 3rd May 1894. His description in the *Summary Report of the Geological Survey of Canada for 1894* gives us a clear conception both of the falls themselves and their geological relations. From it we learn that the falls occur where the river precipitates itself from the plateau lying to the northward into the lower level of an ancient valley or cañon running inland from the sea. There is a perpendicular fall of 316 feet (Bryant's measurement)

into the head or north end of a narrow gorge. This is a zigzagging branch which runs in nearly at right angles from the north wall of the much greater cañon, in which the river flows the remainder of the distance to the sea. Above this branch-gorge, the great cañon was seen to continue on for 25 miles to the north-westward, although it is not now occupied by any considerable stream. The comparatively still river of the plateau, on reaching a pool 4 miles above the falls, rushes down a descent of 200 feet as a strong rapid to the great leap. Below the latter it continues to descend as a boiling torrent about 300 feet more in the branch cañon, within a distance of 5 miles in a straight line, although its crooked course may have a length of 10 miles; so that the total descent in 9 miles will be about 900 feet. On emerging into the great cañon, the river turns south-east and flows as a heavy rapid, which does not freeze in winter, for fifteen miles to Big-hill portage, where the canoe-route to Grand Falls leaves the cañon, and follows a chain of small lakes on the north-east side. Fifty miles below Big-hill portage the river enters a still portion called Winokapow lake, 40 miles in length. At the mouth of the Minipi branch from the south, 40 miles below the outlet of this lake, the general course, which has been very straight, changes from south-east to east-north-east. At Gull rapids, 60 miles from the mouth, the river emerges from the cañon, and a sandy plain intervenes between the river and the rocky hills on either side, all the way to Lake Melville. Hamilton river, therefore, flows 145 miles in the main cañon, which, with the 10 miles in the zigzagging branch-gorge and the above 60, make a total of 215 miles by the river from Grand Falls to the mouth. In order to commemorate the visit of one of the expeditions from the United States, Mr. Low proposes to call the branch-gorge below Grand Falls Bowdoin cañon. The fifteen-miles torrent below it might be called Bryant rapid, in honour of the leader of the other expedition of the same year.

According to Mr. Low's description of the river, if we make the most moderate allowance for the descent in the various rapids and swift parts, in addition to the drop of 800 feet at and above and below the Grand Falls, we shall find the total descent to be about 2000 feet from the commencement, 4 miles above the falls, to the sea. Above the former locality, he says the hills average 300 feet above the river, which would make the general elevation of the country in that region about 2200 feet. The mean between this and Bryant's elevation (1500 feet) of the highest point near Grand Falls would be 1850 feet, which agrees pretty well with our previous estimate of 1800 feet for the general altitude of the interior plateau.

Cañons and Fiords.—The sides of the cañon of Hamilton river vary from about 500 to 1000 feet in height, and are generally nearly perpendicular. The face of the rocky walls, which consist of the common gneiss and granite or syenite of the country, is everywhere fresh and sound, showing that the cañon has not resulted from the decay or erosion of the country rock. I have no doubt that its formation has been due to the decay, in pre-glacial times, of a great dyke, or of several parallel

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dykes of greenstone close together. It would, therefore, be similar to many of the narrow valleys now occupied by long lakes and rivers—stretches in the Archaean region northward of the great lakes of the St. Lawrence and the Winnipeg basin, which I have shown to have originated in this way. Above the permanent water-line, the coarse diorites, diabases, etc., of large dykes decay and crumble rapidly, leaving the walls intact. During the glacial period the deeply-decayed or softened greenstone was easily scooped out by the forward and undulatory movement of the glacier, even when the line of the dyke was at right angles to the direction of the ice-flow.

The great depth of the Hamilton river cañon proves that the land stood at a much higher level before the glacial epoch, but its length is no measure of the time required for its excavation, since this would be performed by ice almost as rapidly in the case of a long dyke as a short one. The cañon has been partly refilled with the glacial *débris* forming the bed over which the present river flows, except, perhaps, at Lake Winokapow, which both Bryant and Low found to have a depth of over 400 feet. The bottom of the ancient valley would, therefore, be below the present level of the surface of the river by this amount, if not more: for even the flow of this lake may consist of glacial drift. From this lake downward the old valley would deepen all the way to the sea.

Various observers have noticed large quantities of greenstones along the river and around Hamilton Inlet, especially near its entrance, as well as elsewhere in this part of Labrador. The dyke or dykes of this rock, out of which the cañon of the river is believed to have been excavated, must be concealed from view in the bottom of the gorge, except as occasional patches, which I have no doubt will be found clinging to the walls in many places. Although the eastern coast of Labrador has been very imperfectly explored, a few cañons, on a smaller scale and excavated on the courses of dykes of intrusive greenstone, have been already noted, and larger ones will very probably be brought to light when this coast becomes better known. McLean refers to a high fall (near which he camped) on the North-West river, below Michikamow lake, "which is here walled in by inaccessible precipices on both sides. The view above the fall is interrupted by stupendous rocks. The natives say the appearance of the river and surrounding country is the same from this fall to Michigama (or Michikamow) lake." This description would seem to indicate that Michikamow river flows in a cañon similar to that of Hamilton river.

The Saguenay fiord and river afford another example of a great cañon evidently excavated along a group of parallel dykes, or on a single great dyke of greenstone, of which others are known to cut the gneiss in the adjacent country. Mr. Low has traced the upward continuation of this valley under the drift through the basin of Lake St. John and for a considerable distance to the westward of it. The general course of the Saguenay cañon is nearly parallel to that of Hamilton river.

A part of the Moisie river is described as running in a similar gorge, having a nearly north-and-south direction, and Mr. Low describes the lower part of the Kaniapiskow river as flowing in a cañon which has a

corresponding bearing. These two gorges lie nearly in one straight line, and they may possibly follow different parts of the same great rift.

Hamilton Inlet (including Lake Melville) is the greatest fiord of Eastern Labrador and runs in for 150 miles from the ocean. Northwards from it the whole coast is serrated with long fiords, several of which run in 40 to 50 miles from the general line of the coast. The water in them is deep; valleys continue inland from their heads, and they are flanked by mountains or high hills of ancient crystalline rocks; in all of which respects they resemble the fiords of Norway and Greenland. They evidently occupy very ancient valleys, which have required a vast length of time for their erosion—so vast that it may have extended back to a pre-Cambrian time, as we shall point out in noticing briefly the geology of Labrador. For 170 miles northward of Hamilton Inlet the fiords run south-west, but from thence to Cape Chidley the inward course of all of them is due west.

GEOLOGY OF FUNDAMENTAL ROCKS. *Laurentian System.*—The prevailing rocks throughout the peninsula of Labrador are gneisses and granites or syenites of Laurentian age, and as far as they have been examined, they have been found to belong to the older part of the system. If the foliation of the gneissic portions be due simply to pressure, it will be difficult to draw a line between these and the non-foliated or granitic rocks of this region. Hornblende granite prevails along Mr. Low's central route from longitude 71° 30', on the East Main river, as far as and around Kaniapiskow lake. In the next 100 miles, or nearly to the Cambrian area, to be noticed further on, he found grey and pink banded hornblende and mica gneisses, and dark coarse mica and hornblende schists. Granite or syenite was also the prevalent rock around the northern and southern parts of Michikamow lake, between this lake and Ossokmanowan lake, including the region around Grand Fal's, and thence southward all along the route followed to the Gulf of St. Lawrence. Granite was the principal rock met with on an exploration by Mr. Low between the south branch of Great Whale river and the lower part of Big river. He also found a small area of this rock at the "jog" on East Main river, about longitude 76°, and another around Obutigamu lake south of Lake Mistassini. The rocks of the eastern coast from Chateau Bay for 70 miles northward are chiefly granite. Massive anorthosites containing iridescent labradorite occur in the central part of Michikamow lake; on the Moisie, Romaine, and St. John river, and on the Atlantic coast at White Bear Arm, Hamilton Inlet, Paul Island, Nain and Port Manvers.

In the basins of the Bersimis and Saguenay rivers, in the southern part of the peninsula, the Laurentian gneisses and other rocks of the series resemble those of the Ottawa valley and probably belong to its newer portion. On the Bersimis, and again on the Ashonapmouchouan, between its falls and forks, Mr. Low found small bands of white and pink crystalline limestones like those of the Ottawa valley. After making allowance for the areas of massive rocks above mentioned, and for those of newer rocks about to be noticed, it may be said that the greater part

of Labrador is built up of Laurentian gneiss. The micaceous and hornblendic varieties are about equally common, and they embrace many shades and textures of greyish and reddish colours. The strike has not yet been ascertained in a sufficient number of places for purposes of generalisation, but in the great majority of the known cases on both the eastern and western coasts it is north-westerly, while on both sides of Hudson Strait it is about due east and west. On the upper part of the East Main river it has also the same direction. This is a somewhat remarkable circumstance, since in the region north of the Ottawa and between the great lakes and Hudson Bay, the prevailing strike is everywhere about south-south-west.

Huronian System.—This geological system in Canada is of interest and importance, being pre-eminently a metalliferous series, and it also contains various economic minerals of a non-metallic character. Unfortunately, it appears to occur but sparingly in Labrador. In 1877 I described a belt of hornblendic and siliceous schists which comes out upon the coast of James Bay at Cape Hope, just north of East Main river. Since then, Mr. Low has found out that this belt runs due east up the river for about 200 miles, with a breadth of about 15 miles. At Paint hills, 40 miles farther north, or in latitude 53° , another band of Huronian rocks comes out to the coast. It consists of hornblendic, micaceous and siliceous schists and a conglomerate having a micaceous matrix enclosing well-rounded pebbles of granite and siliceous schist. Greenish Huronian schists occur on the south side of Richmond Gulf, and the Eskimo make their kettles and lamps of a steatitic schist, probably Huronian, which they find on the coast to the south of Mosquito Bay. Running south-westward from the southern extremity of Lake Mistassini, there is an important band of Huronian strata, consisting of a variety of bedded volcanic or pyroclastic rocks. This band is the north-eastern extremity of the Great Huronian belt, which runs all the way from the lake just named to the outlet of Lake Superior, a distance, on its general course, of 700 miles. A large area of these rocks extends southward from the extremity of the Cambrian belt in the vicinity of the great elbow of the Hamilton river. Smaller areas were seen on the Ashwanipi branch of this river and at Sandy lake, also at Pospiskagami lake on Great Whale river, and on the upper part of East Main river, about longitude 72° . Huronian rocks are reported to occur on the headwaters of the Outarde and Manicouagan rivers. McLean says there is greenstone 60 miles up George river, and that "very fine slate succeeds." On the Atlantic coast I found rocks which may be referred to this system between Nachvak and Ramah, among them being felsitic flag-stones and fine-grained siliceous schists. The Eskimo name of Davis Inlet means "plenty of kettle-stone," which is a soft schist belonging to the series under consideration. Belle Isle was found by Dr Selwyn to be formed of a variety of Huronian rocks resembling those of the Lake Huron region. Similar rocks occupy large districts in Newfoundland.

The "Domino gneiss" of Mr. Lieber (geologist of the U.S. Eclipse Expedition of 1860), so called after Domino Harbour on the east

coast, lies in a depression in the Laurentian rocks about 125 miles long by 25 broad, between Domino Harbour and Cape Webuc or Harrison. Its greatest development is in the neighbourhood of the former place. Here, according to Mr. Lieber, it consists of light-coloured, slightly schistose gneiss, from a fine-grained to a conglomerate character, the latter being due to the presence of small pieces of quartz, which is often green. It also holds large masses of white quartz. The rock being soft and becoming denuded under the weather, leaves these masses projecting from the surface. In the vicinity of Domino Harbour it forms "a low, flat plain about 10 miles broad and 15 to 20 miles long, through which rise bosses of trap. Its surface is but a few feet above the level of the sea . . . with patches of white rock (quartz *?*) glistening in the sun." (Packard's *The Labrador Coast*, p. 287.) The rocks just described appear to be Huronian rather than Laurentian in character, and they may be provisionally placed with the former.

Cambrian System.—Lakes Mistassini and Mistassinis (Little Mistassini) lie in a very ancient geographical depression, remarkable for containing an isolated area of unaltered but also unfossiliferous rocks, which are considered to be of Cambrian age. These lakes are close together and parallel to each other, and they rest wholly within this Cambrian basin, although the central portion of the north-west shore of Lake Mistassini for some distance corresponds exactly with the geographical boundary in that part. The strike is parallel to the length of the lakes, and the basin extends for six miles south-west of the southern extremity of the larger one and to an unknown distance to the north-east of it, and has a width in the central part of 26 miles. The rocks of this basin consist of grey and bluish-grey limestones and dolomites, some beds of which contain cherty concretions while a few are arenaceous. There is also a little black shale, and at the top of the series a layer of conglomerate made up of limestone pebbles in a sandy matrix. The dips are low, varying from 4 to 15 and in one place 20. The portion of the series that can be measured does not exceed 100 feet, but the absolute thickness may be greater.

The long recess in the western coast between Cape Jones and Cape Dufferin is lined all round with a fringe of long narrow islands near and parallel to the coast. They consist of Cambrian rocks, all dipping westward into Hudson Bay. The main shore from Great Whale river nearly to the Nastapoka is formed of rocks belonging to the same system, and they likewise dip into the sea. Their total thickness must amount to thousands of feet. They consist of red and grey sandstones and conglomerates, bedded grey quartzites and hard sandstones, black shales, argillites, with layers of red jasper and hematite, calcareous cherty beds sometimes brecciated, blue and bluish-grey limestones and dolomites, some of them holding cherty nodules and others arenaceous, amygdaloids, greenstones, and quartz-porphyrines. The angles of dip are very moderate, seldom exceeding 5°. The glaciation having been westward, or against the edges of the strata, the escarpments both of the mainland and the islands all face eastward or inland.

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HILLS ON SOUTH SIDE OF LITTLE WHALE RIVER, LOOKING SOUTH-EAST.

From photograph by Mrs. J. A. Allen

These rocks, both in their assemblage and in the characters of their various members, bear a close resemblance to the Animikie and Nipigon series of Lake Superior, and they are all considered to be of Cambrian age. In my (Geological Survey) Report for 1877, I called the series, for convenience, the Manitounuck groups. In some places these rocks are seen to rest unconformably upon the Laurentian gneiss, while in others, as Little Whale river and Richmond gulf, they lie, also unconformably, upon a hard, coarse, thick-bedded or unstratified reddish conglomerate, which I have called the *Intermediate Formation*.

On the Kaniapiskow and its continuation, South river, Mr. Low in 1893 came upon a great belt of rocks like those which have just been described on the west coast. The stream flows upon them for about 120 miles, or nearly to Fort Chimo. Their general strike is NNW., and the dip is to the north-eastward, at angles varying from almost nothing to 40°. The following year the same gentleman found a wide belt of similar rocks, also striking NNW., around Lake Petitsikapow at the great elbow of Hamilton river. Their character, position, and strike render it highly probable that they are a continuation of the great belt of South river. Assuming this to be the case, and that the belt continues no farther north than Leaf river, it would have a length of 350 miles and a breadth of some 35 miles.

On the west side of Ungava Bay, between Leaf river and Bay of Hope's Advance, Mr. Peter McKenzie of the Hudson's Bay Company informed me that the coast and its many adjacent islands consisted in part, at least, of sandstones. These may represent a continuation of the Cambrian belt. On the other hand, owing to the general eastward dip of this belt, its sandstones, which are at the base, would be on the western and not the eastern side. The unaltered or bedded rocks of the whole western side of Ungava Bay and Akpatok Island are provisionally coloured as Silurian on the accompanying map, for reasons to be mentioned further on. In 1890, Mr. P. McKenzie, then resident at Sudbury, gave me a general account of the Cambrian rocks of South river, of which we have now a good description from Mr. Low. The latter found them to consist, in ascending order, of hard, grey sandstone, containing grains of felspar, red sandstone and red and green argillite; a considerable thickness of red, green, and dark shales, passing into an iron-bearing series holding beds of hematite, which, in some places, are about 100 feet thick, with fragments of red jasper scattered through the ore; 1000 feet or more of bluish and grey limestones, partly magnesian and partly siliceous, with which are associated bands of spathic or clay ironstone, probably manganeseiferous, and also some cherty layers. Some of the green and black shales hold much iron pyrites, and their surfaces become rusty under the weather. Cherty rocks form the highest stratified members of the series, but flows of greenstone, 100 feet or more in thickness, cap many of the hills along the river. As a rule, the angle of dip is low, and consequently the hills have long slopes to the north-eastward, with steep faces to the south-westward. Notwithstanding the regularity of the dip, Mr. Low thinks it would not be safe to base any calculation of the thickness upon this fact, since the series may be

faulted by longitudinal upthrusts and partially repeated in various parts.

Michikamow lake lies in an ancient geographical basin, which appears to be still flooded with the lower members of the Labrador Cambrian series, consisting here of red sandstones and shales, which show themselves in patches above the level of the water.

Another proof that Lake Melville likewise occupies a very ancient depression is the fact that the lower portion of the Cambrian series occurs along its northern side. Again, there is a small patch of these rocks in the bottom of the valley of Hamilton river a short distance up. The thick horizontal flows of greenstone at Château Bay, opposite Belle Isle, and the flat-lying beds of hard, coarse sandstone on the north-west side of the straits of the same name, are also considered to be Cambrian.

Silurian System.—Mansfield Island, lying to the west of Cape Wolstenholme, is formed of horizontal beds of grey limestone, which, from the fossils I collected there in 1881, proved to be of about the age of the Niagara formation. Akpatok Island, in Ungava Bay, consists of thinly stratified rocks, supposed to be Silurian. The Laurentian chain of mountains which runs from Cape Wolstenholme along the south side of Hudson Strait ends at Cape Hope's Advance, and from thence to the bay of the same name the whole country is low and flat, being probably underlain by Silurian rocks; and there is some reason to believe that they extend westward along the depression to Mosquito Bay, on the north side of which there is said to be a long cliff of rocks lying in horizontal layers. The drift on the lower levels in McLellan Strait, near Cape Chidley, contains many angular fragments of limestone and shale holding Silurian fossils, and it is believed that these came from the western side of Ungava Bay during the later stages of glaciation.

Surface Geology.—It has been pretty well proved by the geological investigations which have been already made in and around Labrador, that the whole peninsula has been glaciated, with the exception of the higher parts of the mountain range of the Atlantic coast. The direction of the grooving or striation in numerous parts of the country is shown by red arrows on the accompanying map. From these, it is evident that the tendency of the ancient glacier which covered the country was to move from the highest levels outward or towards the sea on all sides. Along the southern and western coasts, the rounding and planing down of the rocks is well marked, showing that the action of the ice has been long continued or intense. But on the Atlantic coast the glacial striae are very light, and they are to be found only on the lower levels or in valleys, down which they run directly towards the ocean. The course of the ice grooves has not been noted anywhere in the interior of the northern division of Labrador, but along the north slope of the mountain chain overlooking the south side of Hudson Strait they all run eastward. The same course is maintained everywhere on the north shore of the Strait. The "stoss" or rounded ends of glaciated ridges on both sides is always towards the west, showing that during the glacial epoch a

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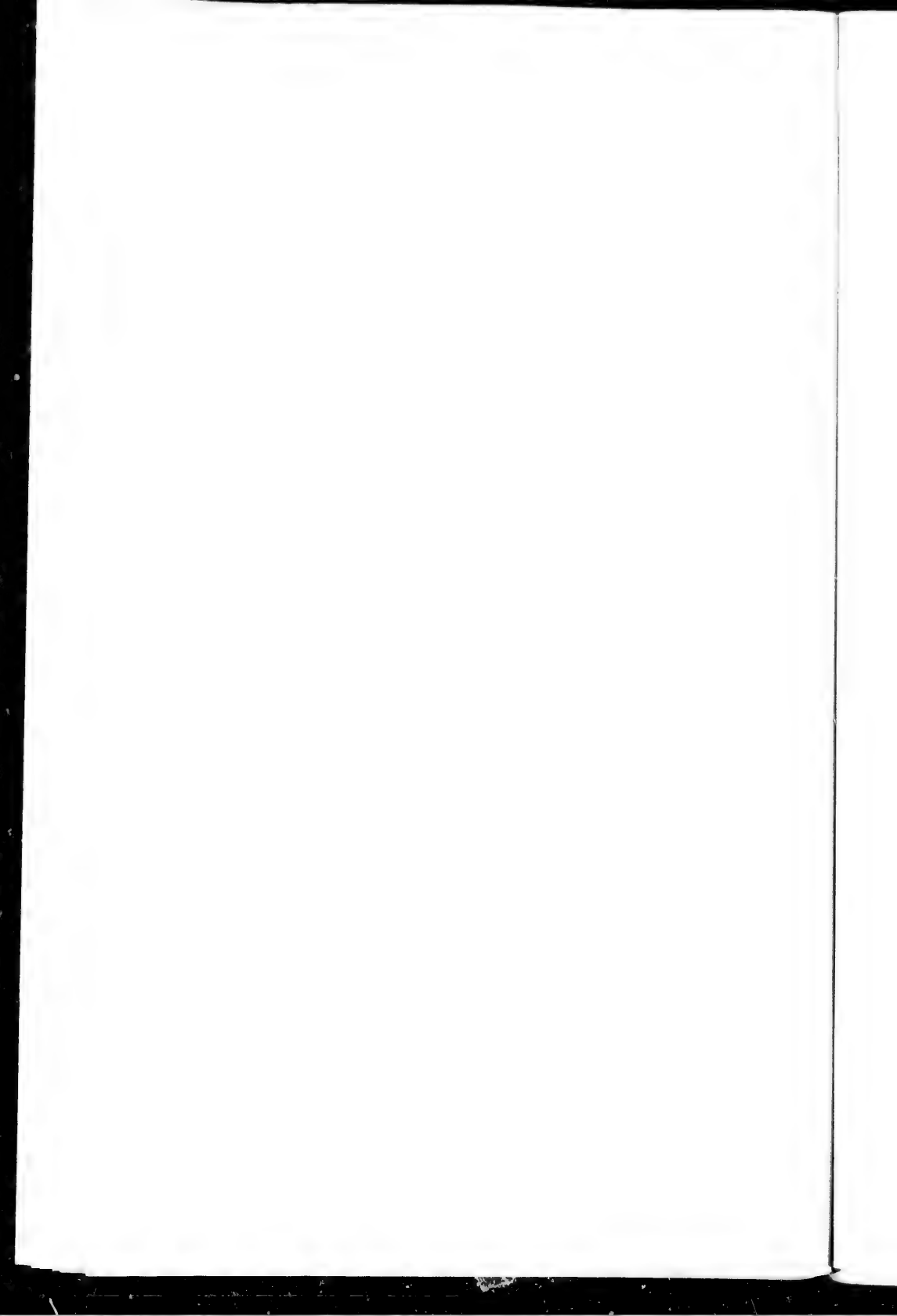
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LOUISIANA HARBOR, NEAR VAIN.

See Plate 10, p. 10.



great ice-stream passed down this channel into the Atlantic. The composition of the drift on the shores of the Strait also proves this movement, its materials at any point having come from the westward. General conditions, both during the glacial epoch and at the present day, would also show that this must have been the direction of the movement in the valley now occupied by the Strait, since the course of glaciers has always been from the continent towards the ocean and not *vice versa*.

The islands, near the east side of Hudson Bay, which Captain Gordon and I named 'the Ottawa group, in latitude $59^{\circ} 45'$, longitude 80° , are well glaciated on their lower levels. The direction of the striae varies somewhat in different parts, but the general trend of the movement of the ancient glacier here was evidently northward. There can be little doubt that the basin of Hudson Bay was dry land during the glacial epoch; and it is probable that part of the ice which then lay upon its bed moved northward to join another stream from Fox Channel, and that the united glacier then passed down the great valley now occupied by Hudson Strait. The very high and bold land at Cape Wolstenholme seems to have acted as a *pièce de résistance* against the ice-stream from Hudson Bay. On Outer Digges Island, off the Cape, which is also moderately high, the striation and the forms of the glaciated buttresses show that the ice here moved north-eastward, round the corner, as it were, or that its course here changed from north to east.

The abundance of boulders is one of the characteristics of Labrador. The surface of the country is nearly everywhere encumbered with them. They are scattered about promiscuously and are of all sizes, or they form ridges and piles in all kinds of situations. They may be observed perched singly or in groups on the sides and tops of hills where it would seem very easy to dislodge them, showing that no severe earthquake shocks have occurred in Labrador since the glacier melted away and gently deposited these boulders in their present situations. Large rounded blocks are often seen supported by smaller ones, so as to leave a clear air-space beneath them.

In the centre of the peninsula, Mr. Low says the boulders or loose masses of rock and also the smaller fragments are mostly angular and not far-travelled, which would help to prove that this was the region of *névé*, from which the ice started in different directions, as indicated by the striae. He observed hills of drift and morainic ridges in many parts. The latter were often pitted with large holes or hollows like the "kettle moraines" of the United States geologists, these depressions having been left by the melting away of large masses of ice which had been incorporated with the more lasting materials at the time the ridges were formed by glaciers. Mr. Low also detected long low ridges of finer and further transported drift material, like the osars of Scandinavia.

Raised beaches occur along all the coasts of Labrador, and afford very striking evidence to even the most casual observer of the elevation of the land. On the lower levels the evidence is so fresh that this elevation must have taken place within a very recent geological period, and it appears to be still going on. On the west, or Hudson Bay coast, long

lines of drift-wood are found up to 30 feet, or more, above high-tide mark, and deep-water deposits, containing fresh-looking shells, have been raised above the present level of the sea; while shallow-water deposits, with their characteristic shells, are frequently met with at higher levels. Fish traps constructed of stones, and other shore works of bygone generations of Eskimo, are now raised high above the sea-level. The numerous terraces overlooking the bay preserve their steep faces, and the smooth gravel and shingle of which they are formed is still bare and almost as fresh-looking as that of the present shore.

Similar conditions exist on the northern and eastern coasts. In regard to an ancient beach, 200 feet above the sea in Indian Harbour, off Hamilton Inlet, Packard says: "Its shingly surface was free from vegetation and it looked as though the waves had receded from it but the night before" (*The Labrador Coast*, p. 170). In an uplifted sea bottom, forming the present beach at Hopedale, Packard found the stones and pebbles "covered with nullipores and polyzoa; the *Mya truncata* still remains perpendicular in its holes, and the most delicate shells, with their epidermis still on, are unbroken, and their valves often united by the ligament. . . . It is evident that this deposit has slowly and almost imperceptibly risen some 400 or 500 feet, without any paroxysmal movement of the continent, over an extent of coast some 600 miles in length." (*Ibid.*, p. 324.) Between Belle Isle and Hopedale the same traveller noticed raised beaches in upwards of 75 different places. They make about 12 terrace-levels, ranging up to 500 feet, but most of them are under 200 feet.

Farther north, raised beaches occur at much higher levels. Some seen at Nachvak Inlet I estimated to be about 1500 feet above the sea. I also found high shore-lines on Marble Island in the north-western part of Hudson Bay, and similar lines, at great heights, have been observed by others in Roe's Welcome and on the land still farther north. McLean says: "Along certain parts of the (east) coast of Labrador rows of boulders are perceived, lying in horizontal lines, the lower about 200 yards distant from high-water mark, while the farthest extend to near the crest of the adjacent hills."

Professor J. W. Spencer has found by the actual levelling of ancient beaches over long distances in the province of Ontario and the State of New York, that there is a differential elevation of the land towards the north-east amounting to from one to three feet in a mile. If the amount were even much less, and it extended into the Labrador peninsula, we should there expect to find very high beaches.

Economic Minerals.—The upper beds on nearly all of the long islands near the east coast of Hudson Bay, between Little Whale and Nastapoka rivers, consist of a rich manganiferous spathic iron-ore. The islands are destitute of trees, and their long gentle slopes to the sea expose millions of tons of the ore, which could be broken up and shipped at small cost. The quantity is practically inexhaustible. The thick beds of hematite which Mr. Low saw in the Cambrian rocks along South river exposed millions of tons of ore close to the stream and more in the

hillsides. Similar ore in abundance accompanies these rocks in the southern extension of this band around Petitsikapow lake.

Copper ore is reported to occur in different places on the Atlantic coast, but no definite or reliable information is available regarding their deposits. I have received good specimens of copper pyrites from Indian Island off the entrance of Hamilton Inlet.

Galena occurs as small and large segregations, often weighing nearly one hundred pounds and apparently in workable quantities, in a twenty-foot bed of limestone in the Manitounuck (Cambrian) rocks at Little Whale river and Richmond gulf and, probably, in the same bed all the way between these localities. It contains scarcely enough silver to be worth extracting.

Gold was found in traces on assaying samples of quartz from veins at Nachvak, Cape Chidley, and one of the Ottawa Islands. In various places on the Atlantic coast the schistose and granitoid rocks contain large isolated masses of quartz. Those in the "Domino quartzites" have been already referred to. They would be worth assaying for gold, for should they be found to contain even a few pennyweights to the ton, it would pay to work them in such an accessible region.

Among the ornamental stones of the peninsula the different forms of labradorite are the best known. A massive variety with iridescent spots occurs at Hamilton Inlet. The Eskimo mine the precious kind on Paul Island, and the mineral is sent from Nain by the missionary ships. It exhibits a number of beautiful colours, including dark and light blues and greens, red, fire-colour, steel-grey, etc. Mr. Low found fine specimens of this mineral at Michikamow lake. Amazon-stone and fine pavlite occur at Port Manvers. On the western side, the amygdaloids of the coast about Richmond Gulf are full of agates and cornelians, and on an island near Great Whale river a fine variety of translucent green quartz is found in small veins.

Various other minerals and rocks are found in Labrador which would be of value in a more thickly-inhabited country. Among them may be mentioned the excellent building stones which abound among the Cambrian rocks of the west coast and the flagstones of Ramah on the east. The Eskimo of Cape Wolstenholme bring good whetstones in the form of long splinters which are easily smoothed into shape. On South river, a little above the Forks, Mr. Low found among the Cambrian rocks a compact white siliceous stone which appears to be identical with the novaculite of Washita in Arkansas, so highly prized for hones.

Anthracite of excellent quality is found on Long Island, off Cape Jones, but it appears to have resulted from the alteration of a mineral like albertite, and occurs in veins in the Cambrian rocks of the island. Mr. Low found a vein of a similar mineral near the southern extremity of the great belt of Cambrian rocks of the interior.

Climate.—It would not be possible in the limits of this paper to give a satisfactory account of the climate of a country so extensive as Labrador. While the southern extremity is temperate and pleasant, the northern part borders on the Arctic. Owing to the influence of the sea,

the cold around the coasts is not so intense as in the inhabited portions of our North-west Territory, but as the winter is longer, ice forms to a greater thickness, amounting to seven feet at Hamilton river, according to Mr. Low. The snow is moderately deep in winter, and there are copious rains in the spring and summer. The forests form a better index of the climate than columns of meteorological statistics. Although it must be confessed that the country as a whole is poor both as to climate and soil, yet it is not so forbidding as has been represented. Professor H. Y. Hind in his work on Labrador, published in 1863, says: "Language fails to paint the awful desolation of the table-land of the Labrador peninsula." On the other hand, Mr. Low, who returned in 1894 from a two years' exploration of the interior, says: "These explorations will give a good idea of the physical aspect and climate of the interior, about which very little was previously known by the public, and will correct the popular idea that the Labrador peninsula is a waste, barren region, totally unfit for habitation." (*Summary Report of the Geological Survey for 1894*, p. 80.) Professor Hind saw but little of the interior.

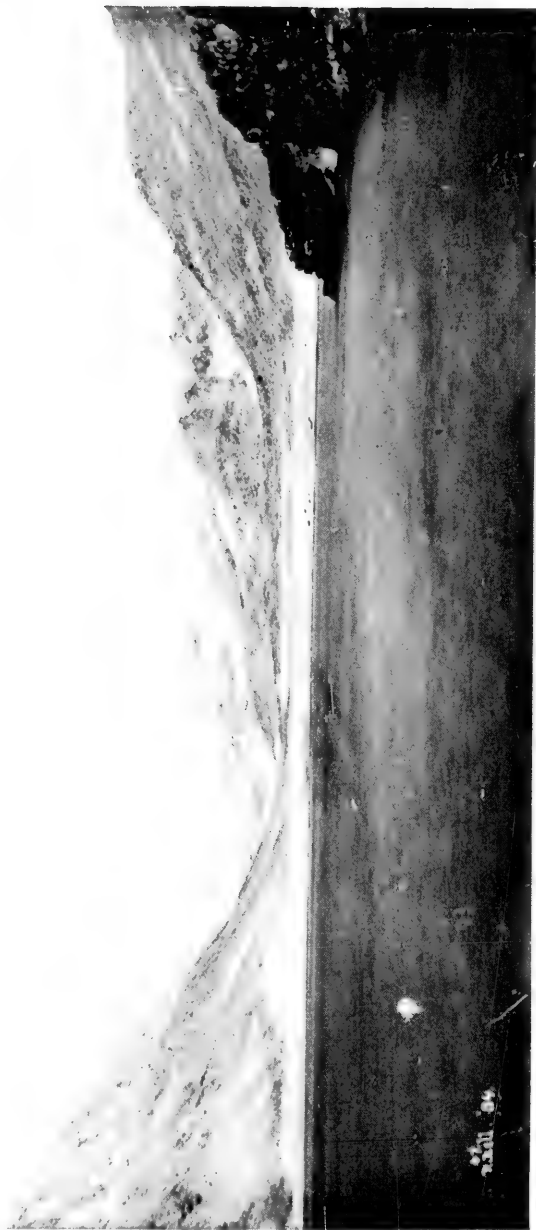
Forests.—The Labrador peninsula, as a whole, may be said to be more or less clothed with forest, with the exception of a small area in the north-western extremity and another along the northern part of the Atlantic coast, which may be called barren grounds like those north of the forests on the west side of Hudson Bay. Mr. Low says that, in a general way, the country northward to latitude 54° is pretty well covered by continuous forest, except on the hill-tops in certain districts. Northward of this latitude its continuity is broken by treeless spots and patches of greater or less extent, and the timber is found principally in the valleys and lowlands. The accompanying map shows the northern limits and the peculiarities of distribution of the prevailing kinds. These lines may in the future require to be somewhat modified in regard to details, but for the present they can be taken as approximately correct. They are laid down from information derived from all the sources mentioned in previous pages, the latest being Mr. Low's report. If we take any point on the map, it is to be assumed that all the trees whose boundaries lie to the northward of it are to be found in the vicinity of such a point, except the balsam, poplar, and Banksian pine, whose limits describe unusual curves.

Within the boundaries of the peninsula, as given in the beginning of this article, at least twenty-four different kinds of forest trees are to be found, which is about as many as are native to all Europe. Whether we consider their extent or the variety of the trees, it will therefore be seen that the forests of Labrador are not to be despised. A certain number of the species, however, grow only in the southern part, and a few of them are confined to a small area, even there; still there is a considerable diversity in the trees of the greater portion of the peninsula. The white spruce (*Picea alba*), black spruce (*P. nigra*), and larch or tamarack (*Larix Americana*), are the most plentiful and most generally diffused of the conifers. These three trees are about equally northern in their range, which extends

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SACHIVAR INLET SOUTH SIDE, NEAR ENTRANCE.

From Photograph by Dr. Hall

considerably beyond that of any other species. The limit of the balsam fir (*Abies balsamea*) is considerably farther south, but still the tree is found throughout more than two-thirds of Labrador. Banksian pine (*Pinus Banksiana*) grows as far north as Great Whale river, but it avoids the East Main coast, and its limit appears to curve southward before reaching Michikamow lake. Its southern line on the north side of the St. Lawrence keeps a short distance back from the river all along, and it seems to shun the salt water. The northern limit of white pine (*P. strobus*) extends east about as far as Mingan. It is an abundant and valuable tree in Newfoundland. Red pine (*P. resinosa*) occupies only a small area north of the Saguenay. The north line of the white cedar (*Thuja occidentalis*) runs from Rupert's House to the vicinity of Pointe des Monts. It is a remarkable fact that this tree, though large and fine in Gaspé and New Brunswick, is absent from Anticosti, Newfoundland, Nova Scotia (except a small part adjacent to New Brunswick), and the eastern part of Prince Edward Island. Although no person appears to have observed the balsam poplar (*Populus balsamifera*) in the large area in the centre of Labrador, indicated on the map, it cannot be asserted that it does not exist there. On the west side of Hudson Bay, this is the most northern deciduous tree. The large-toothed poplar (*P. grandidentata*) is found only in the south of Labrador, while the aspen (*P. tremuloides*) ranges far north. The bird cherry (*Prunus Pennsylvanica*) has nearly the same range as the latter. The northern limit of the canoe birch (*Betula papyrifera*) reaches the forks of the Ungava river, which may be a little beyond the known limit of the balsam poplar. In many of the valleys it attains a sufficient size for its bark to be used in building canoes. Black alder (*Alnus incana*) and black willow (*Salix nigra*) have a wide range in the southern half of the peninsula. The yellow birch (*Betula lutea*), mountain ash or American rowan (*Pirus Americana*), black ash (*Fraxinus sambucifolia*), sugar maple (*Acer saccharinum*), red or soft maple (*A. rubrum*), and mountain maple (*A. spicatum*), are all confined to small areas in the south. White or grey elm (*Ulmus Americana*), basswood or linden (*Tilia Americana*), and red oak (*Quercus rubra*) are found around Lake St. John, where the soil and climate are exceptionally favourable. The following trees flourish in the valley of the St. Lawrence, close to the southern point of the Labrador peninsula as above defined, namely, hemlock (*Isuga Canadensis*), ironwood (*Ostrya Virginica*), American beech (*Fagus ferruginea*), white ash (*Fraxinus Americana*), blue beech (*Carpinus Caroliana*) and scarlet-fruited thorn (*Crataegus coccinea*). Among the numerous kinds of shrubs growing in Labrador, the rowan bush (*Pirus sambucifolia*), whose northern limit is marked on the map, deserves mention, as its berries constitute the food on which the marten depends when rabbits and other animals are not to be had. The fur of the marten is one of the most valuable productions of Labrador.

No timber is yet exported from Labrador. The larger trees in the southern parts are fit to be sawn into lumber; but the wood of the country in general will be valuable in future only for such purposes as making paper pulp, railway ties, telegraph poles, small spars, fencing, house-building, timbering mines, firewood, making charcoal, etc. The trees

seldom reach two feet in diameter, and are generally less than one foot. Their size appears to depend more on soil and shelter than on the latitude, for some of the finest forests are to be found in the northern parts. In reference to Erlandson lake, in latitude 57, Mr. McLean says: "The circumjacent country is remarkably well wooded, even to the tops of the highest hills." Leaving this lake and journeying southward, he says: "Passed over several small lakes; the country well wooded. Entered upon a small river about noon; the banks covered with large pine." (White-spruce is called "pine" by the Hudson's Bay Company's people.) In the thirty-four miles of his route southward from Erlandson lake, when he reached Whale river (of Ungava Bay), he says: "The face of the country presents scarcely any variety; from Erlandson lake to this river it is generally well wooded, but afterwards (southward) becomes extremely barren—nothing to be seen on both sides of the river but bare rocks." Further on he passed through a good deal of wooded country to the height of land. Mr. Low noticed that on the lower part of South river near the Forks, the black spruce, larch, and white birch were all larger than higher up the stream. He says that, on the Cambrian belt of rocks, in the vicinity of Lake Petitsikapow, "there is also a marked improvement in the size of the trees due to a richer soil covering this area: and along the river and in the valleys, white, black, and balsam spruce are frequently met with, over twenty-four inches in diameter three feet from the ground. White birch also grows larger and more abundantly than elsewhere." (*Summary Report of the Geological Survey for 1894*, p. 77.) Forest fires every year destroy much timber in the interior of Labrador, as elsewhere in northern Canada. The process appears to have been going on from time immemorial, and young trees are constantly growing up to replace those destroyed, so that "second growths" of all ages are to be met with at intervals throughout the country.

Fluna.—The sea around the whole coast of Labrador is well stocked with numerous species of cetaceans and seals. The walrus in large numbers inhabits all the northern parts of the coast and adjacent islands. Among the land mammals nearly all the fur-bearing animals of eastern North America are more or less plentifully represented. The beaver is scarce, perhaps on account of the great thickness of the ice on the lakes in winter. Beyond the edge of the forest the principal fur-bearing animals are the red fox and its varieties, the cross and silver or black, the white and the blue fox, the wolf, the wolverine, the polar bear and the grizzly. The last named has also been called the "barren-ground bear" and possesses much interest for the zoologist. Of him McLean says: "When we consider the great extent of country that intervenes between Ungava and the plains of the far west, it seems quite inexplicable that the grizzly should be found in so isolated a situation and not in the intermediate country. The fact of their being here, however, does not admit of a doubt, for I have traded and sent to England several of their skins." Captain Kennedy, who was in charge of the Ungava for many years, informed me that he had collected many skins of this animal in the district. Can his presence here be connected with the fact that the elevated Labrador coast

range continues northward to high latitudes along the west side of Davis Strait, Baffin Bay, and the lands thence northward as far as explorers have gone?

The moose and the woodland caribou are occasionally seen in the south-western part of the peninsula, and the reindeer, or barren-ground caribou, is abundant in the north. These animals appear to migrate annually in a wide circle. Starting late in summer for the west coast, they follow the verge of the forest eastward, cross the Ungava river in September and October, and on reaching the Atlantic coast turn southward and then westward, through the woods, in the winter, to their original starting-place. Others cross and recross the Ungava river in the month of March. Mr. Peck states that along the Natwakame river the reindeer have beaten wide trails parallel to the banks of the stream, which his men found very convenient to use as portage roads past the rapids. In the month of August 1877 these animals were numerous near the coast to the north of Little Whale river and the Eskimo were shooting them with their bows and arrows. During summer the Eskimo kill many reindeer in the northern division of the peninsula, especially near Hudson Strait, to the west of Cape Hope's Advance. Deer of all kinds have become exterminated throughout the southern water-shed of the peninsula, principally through the improvidence of the Indians.

According to Mr. Lucien Turner, who has studied the subject for the Smithsonian Institution, 209 species of birds have been noted as occurring in Labrador. With the exception of the two species of ptarmigan, game birds are not plentiful. This is especially the case with the aquatic birds, and the fact is due to the scarcity of their food.

The staple sea fishes of the Atlantic coast are the cod and herring. The haddock does not appear to extend north of Belle Isle. Capelin, the great food of the cod, are on all the coasts. I picked up a flatfish in Hudson Strait which I took to be a young halibut. The question of the existence, or otherwise, of the common cod in Hudson Bay is one involving millions of dollars, and it remains unsettled up to the present time. I have seen and eaten rock cod, several pounds in weight, taken in nets on the east side of James Bay, and since the conditions are favourable for their propagation, it is reasonable to suppose that the ordinary cod can also breed in Hudson Bay, where all the requirements of his existence appear to exist. The common salmon (*Salmo salar*) is found in all the larger streams from the Saguenay to Hudson Strait, and is particularly abundant in the rivers of Ungava Bay. Hearne's salmon (*S. Hearni*) is caught in the rivers of the Strait and on both sides of Hudson Bay, and sea-trout in the mouths of all the rivers around the entire coast-line. The win-iwish, or "land-locked salmon," inhabits Lake St. John and all the lakes connected with Hamilton river as far as known. The large lake whitefish abounds in nearly all the inland waters, and is also caught in salt water on the east side of James Bay. Speckled trout are abundant in all the streams and lakes. A large species of sturgeon, which is common in the lakes and rivers of the drift-covered country on the west side of Hudson Bay, is also found in the lower parts of the streams on the east side of James Bay within the area marked on the map as being mostly under 600 feet

above sea-level. The other fresh-water fishes comprise the herring-whitfish, the mari, dog-fish or ling, pike, pike-perch, and suckers of different species.

Population.—The figures in the table below are derived from the following sources. The resident white population of the Atlantic coast, from Blanc Sablon northward, is from the Newfoundland Government census of 1891, and there has been little change since that time. Both the white and Indian populations from Blanc Sablon to the west end of Lake St. John are from the Dominion Government census of 1891, and there may have been some increase in the number of whites, but this is uncertain. The remainder of the Indian population is a good approximation to the number at present trading at the different posts of the Hudson Bay Company. Previous estimates have greatly overstated the numbers of the Indians of the interior. The Eskimo begin to be met with in straggling numbers at Hamilton Inlet, and they extend up the Atlantic coast, along Hudson Strait, and down the west coast as far as Cape Jones. The figure given for the coasts from Cape Chidley to Cape Jones was found by adding together my own estimates of the numbers at all their different settlements and camps, and it may, perhaps, be slightly under the mark. Some of these people hunt the reindeer at certain seasons a short distance inland on the barren grounds, but they all come to the coast as their homes. In 1860 there were 1400 Eskimo belonging to all the Moravian settlements, and the numbers have remained almost stationary. The Secretary of the Moravian Missions in Labrador, referring to 1887, wrote to Dr. Packard: "We reckon that there are less than 1500 Eskimo on the strip of coast from Hamilton Inlet to Ungava."

POPULATION OF THE LABRADOR PENINSULA.

	Numbers.
Atlantic coast from Blanc Sablon to Cape Chidley—Whites	4,100
North shore of St. Lawrence from Blanc Sablon to Tadoussac in 1891—	
Whites	7,915
Ditto—Indians	1,387
On north side of Saguenay and Lake St. John—Whites	1,324
Ditto—Indians	431
On east coast of Hudson Bay—Whites	40
Indians trading at Hamilton Inlet	125
Ditto at Davis Inlet (Naskopies)	230
Ditto at Fort Chimo (Naskopies)	90
Ditto at Nitchiquan, Mistassini, and Waswanipi (all Montagnais)	230
Crees and Montagnais trading at Rupert's House	250
Ditto trading at other ports on east side of Hudson Bay	270
	1,195
Eskimo at and between Moravian settlements on Atlantic coast	1,400
Ditto, thence northward to Cape Chidley	50
Ditto from Cape Chidley to Cape Jones	650
	18,495

Total white population (resident), 13,379; Indian, 3016; Eskimo, 2100. Taking the area of the peninsula at 560,000 square miles this would only

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From Photograph by John J. Cooper

ESKIMO AND LITTLE WHITE WHALE (baleen whale) at the MOUTH OF GREAT WHALE RIVER.



From Sketch by Dr. Bell

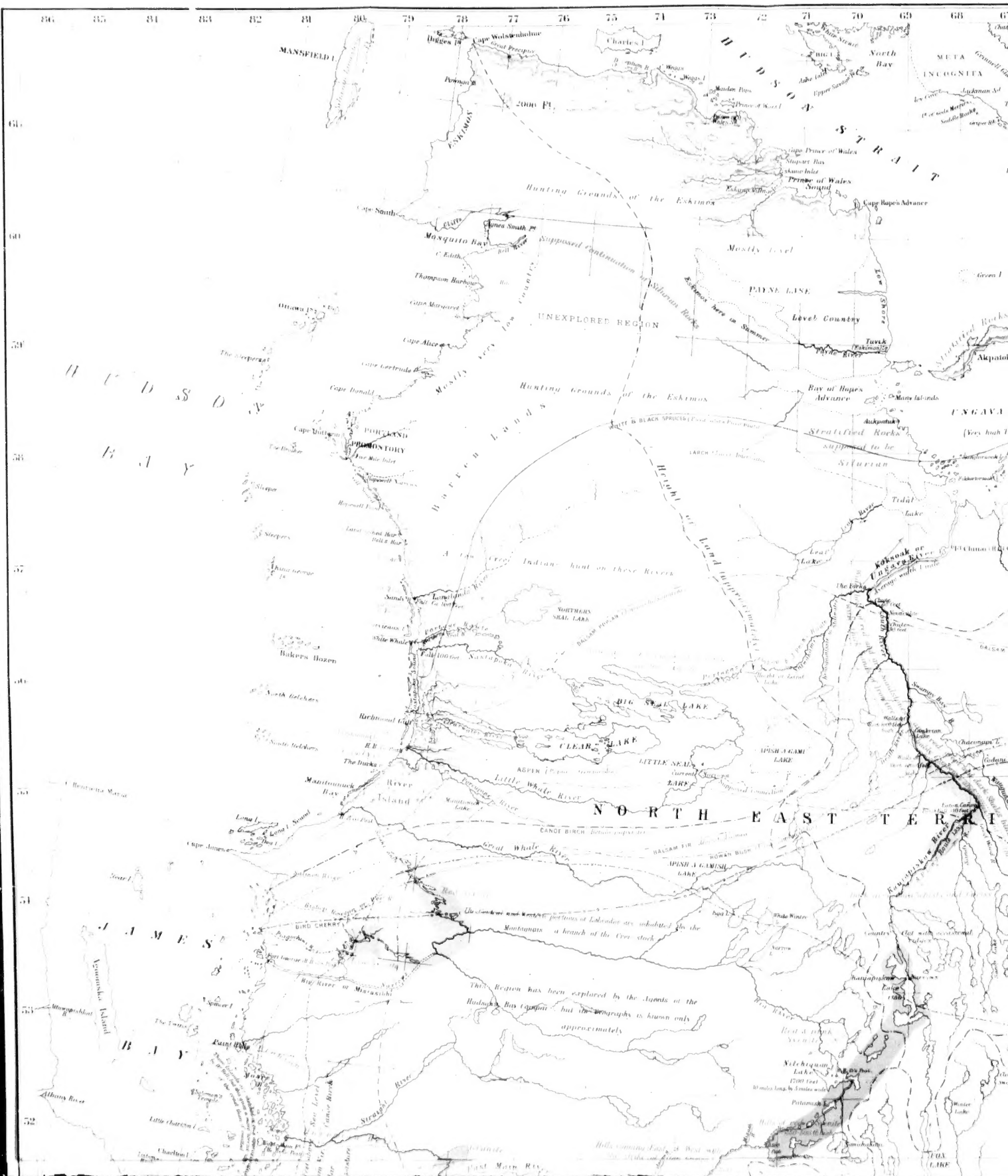
CAPE WOLSTENHOLME, SOUTH SIDE OF HUDSON STRAIT, OVER 1000 FEET HIGH.

give one inhabitant to each 30 square miles of territory. It is estimated that at least 1000 schooners, mostly from Newfoundland, proceed to the Atlantic coast of Labrador every summer to fish. Many of these carry several families, but at the rate of only ten persons to each schooner this would give a floating population of 10,000 during three months of each year. In addition to these a considerable number of tourists from the United States and elsewhere visit the coast every summer.

Moravian Missions.—The Unity of Moravian Brethren, or Unitas Fratrum, has six stations on the Atlantic Coast of Labrador for the benefit of the Eskimo. They are situated in the following order from south to north :—

Station.	Founded.	Number of Eskimo in 1886.
Hopedale	1782	160
Zoar	1865	90
Nain	1771	214
Okkak	1776	308
Hebron	1830	207
Ramah	1871	71
		1050

The late Rev. B. La Trobe, secretary in London of the Moravian Missions, said that there were in 1886 less than 1500 Eskimo on the whole coast. If we allow 350 for those residing at various places between the mission stations, and 50 for those between Ramah and Cape Chidley, the whole number becomes 1450, which is not far from correct for the present year (1895), as the numbers appear to have remained about stationary for a long time. These people have improved very much in their moral and spiritual character under the influence of the devoted missionaries, although their self-reliance and physical stamina are not equal to those of the heathen Eskimo of Hudson Strait. The Moravians endeavour to make the missions self-supporting as far as possible, and for this end they encourage the Eskimo to hunt foxes and other fur-bearing animals, for which purpose they lend them traps and supply ammunition, and then pay them fair prices for their returns. The mission ship, of which successive ones have been called the *Harmony*, visits the stations each summer for the purpose of bringing the outfits and taking back the produce of the year's trade. The natives speak German, and appear to be fond of their religious exercises, especially the singing. In 1893 some enterprising Americans transported upwards of fifty of them, including men, women, and children, from Nain to Chicago, where they remained during the Columbian Exhibition. On their return, these simple children of nature would doubtless have endless stories to tell to their wondering relations.



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Scale 1 : 3,168,000 or 50 Miles to 1 Inch

English Miles (69,16) 1

REFERENCE

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|--|---|
| | <i>Unfolded Siberian Limestone, Shales, Sandstones, etc.</i> |
| | <i>Cambrian Strata: Quartzites, Sandstones, Shales, Limestones, Ironstones, Amphibolites, etc. – apparently equivalent to the Anisimov and Asypion Series of Lake Superior.</i> |
| | <i>Huronian System, consisting of Pyroclastic Rocks, such as Agglomerates, Crystalline Schists, etc.</i> |
| | <i>First Gneisses and Syenites – Laurentian</i> |
| | <i>Anorthoxites – Laurentian.</i> |

* General Course of Glacial Striae at each locality

The uncoloured Portion of Labrador consists of Laurentian Gneisses as far as known

Limits of the various Native Tribes in Labrador are distinguished by different line lines.

